Course Syllabus
- CSC 311 -

Semester: Winter 2023
Course title: Algorithms Design and Analysis
Credit hours: 3
Instructor: Prof. Mohamed Maher Ben Ismail (mbenismail@ksu.edu.sa)
Website: http://staff.ksu.edu.sa/mbenismail
Office: 2242
Office hours: Check the web site of the course.

Goals of the course: This is an undergraduate course on the design and analysis of algorithms. The aim of the course is to provide a solid background in designing and analyzing algorithms. It is expected that students will be able to analyze and compare algorithms based on their efficiency, and also design algorithms using several algorithm design paradigms.

Recommended textbooks:
Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3/e, Pearson, 2012.
Cormen, Leiserson, Rivest and Stein, Introduction to Algorithms, 3/e, MIT Press, 2009.

Course Learning Outcomes:
Upon the completion of this course, the student should be able to:
- Analyze the running times of algorithms using asymptotic analysis.
- Synthesize algorithms that employ graph computations as key components, and analyze them.
- Apply algorithm design techniques to solve some practical problems through a course project.
- Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
- Design algorithms using different design paradigms, and analyze them.
- Function effectively as a member a team engaged in a computing project.

Topics (tentative):
Mathematical preliminaries, asymptotic notations, practical complexities, common design techniques and examples: brute force, divide and conquer, greedy algorithms, dynamic programming, graphs, introduction to NP-Completeness.

Topics	Planned Contact Hours
Introduction + Mathematical essentials	**3L+1T**
Growth of functions and asymptotic notations: Little-Oh, Big-Oh, Little-Omega, Big-Omega, Theta.	**3L+1T**
Performance analysis of non-recursive algorithms	**3L+1T**
Performance analysis of recursive algorithms: Recursive substitution, Recursion tree, Master theorem.	**3L+1T**
Brute force algorithms: Sorting, String Matching, 0/1-Knapsack, Convex Hull, Matrix Multiplication.	**3L+1T**
Divide and conquer algorithms: MergeSort, QuickSort, Strassen's matrix multiplication.	**3L+1T**
Dynamic Programming: Longest Common Subsequence, 0/1-Knapsack, Matrix Chain Multiplication.	**4L+1T**
Graphs: Representation, Traversal, Breadth search first, Depth first search, Minimum spanning tree, Bellman Ford.	**3L+1T**
Greedy algorithms: Prim's, Kruskal, Dijkstra, Job scheduling.	**4L+1T**
Introduction to NP-Completeness.	**3L+1T**

Evaluation:

- **Tutorials:**   5 marks
- **Quizzes (3):**   15 marks
- **Programming Project:** 15 marks
- **Midterm exam:**   25 marks
- **Final exam:**   40 marks

Notes for email communication:

- Your email header must start with *CSC311*
- Send your email to mbenismail@KSU.edu.sa email address.
- Please write your name and your ID at the end of the email

Collaboration and attendance policies:

- Discussions about the course material are highly recommended. However, the student is not allowed to look at or copy any part of any homework or exam of other students. Plagiarism or any kind of cheating will not be tolerated and a student caught with that will end up having a grade of F.
- A student with an absence rate more than 25% will be denied from attending the final exam. An excuse for being absent is accepted only if it is legitimate and submitted within one week of the absence date.